

AFFECTED ENVIRONMENT



INTRODUCTION

This chapter describes the existing environmental conditions in the study area. It provides the descriptive information necessary to understand current conditions and the context for comparing potential impacts caused by each designation alternative. The degree of detail satisfies the requirements of an environmental assessment (ECA) as prescribed by the National Environmental Policy Act (NEPA).

The proposed Captain John Smith Chesapeake National Historic Trail is comprised of multiple routes extending approximately 2,300 miles along the Chesapeake Bay and portions of eight of the major tributaries of the Chesapeake Bay: the Potomac, Patuxent, Susquehanna, Patapsco, Nanticoke, Rappahannock, York, and James Rivers. The trail study area falls within the states of Virginia, Maryland, Delaware and the District of Columbia.

CULTURAL RESOURCES

Cultural resources for the purposes of this Environmental Assessment include historic properties, archeological resources, and ethnographic resources.

Historic Resources

The Chesapeake Bay region is endowed with a wide array of historic structures and sites, and

the efforts to identify and protect these invaluable resources continue today. Within the study area, there are seven units of the National Park System, as previously described in Chapter Two. There are a number of National Historic Landmarks in proximity to the proposed trail; those potentially thematically related to the trail are listed below, in Figure 1.

The National Register of Historic Places contains detailed records on hundreds of properties within the area of consideration, and scores more remain either eligible or potentially eligible for listing on the register. Figure 2, below, lists National Register sites with seventeenth-century themes. Map 8 shows all National Register sites in proximity to John Smith's voyage stops, though most are not directly related thematically to the proposed John Smith trail.

Relevant to the John Smith voyages is Colonial National Historical Park (NHP), which administers two of the most historically significant sites in English North America. Historic Jamestowne, the first permanent English settlement in North America in 1607, jointly administered with the Association for the Preservation of Virginia Antiquities, and Yorktown Battlefield, the final major battle of the American Revolutionary War in 1781. These two sites represent the beginning and

end of English colonial America. Situated on the Virginia Peninsula, these sites are connected by the twenty-three-mile scenic Colonial Parkway. Colonial NHP also includes the Cape Henry Memorial, which marks the approximate site of the first landing of the Jamestown colonists on the Atlantic Coast in April of 1607.

Historic Jamestowne was the beginning of England's successful colonization of America. It was the first permanent English colony on the North American continent; the first seat

of English government in Virginia and its social and political center for ninety-two years; where the first English representative government in the New World met in 1619, the foundations of our form of government today; and at Jamestown that the first arrival of Africans to Virginia was recorded, although they actually landed at Cape Comfort. The Cape Henry Memorial marks the approximate site of the first landing of the Jamestown colonists on the Atlantic Coast in April of 1607.

Figure 1: National Historic Landmarks related to English Exploration and Settlement:

St. Mary's City Historic District, St. Mary's County, Maryland
 Bacon's Castle, Surry County, Virginia
 St. Luke's Church, Smithfield, Isle of Wight, Virginia
 Shirley Plantation, Between Richmond and Williamsburg Charles City County, Virginia

Figure 2: National Register sites related to Seventeenth Century Exploration and Settlement:

VA Accomack County	Scarborough House Archeological Site (44AC4), Davis Wharf
VA Charles City County	Dogham, Doggams, Charles City
VA Chesterfield County:	Falling Creek Ironworks Archeological Site, Richmond
VA Gloucester County	Warner Hall, Gloucester
	Werowocomoco Archeological Site, Gloucester
Virginia Henrico County	Varina Plantation, Varina
VA Hopewell Independent City	City Point Historic District, Hopewell
VA James City County	Colonial National Historical Park, Jamestown
	Jamestown National Historic Site, Jamestown Island in Jamestown
VA Middlesex County	Urbanna Historic District, Urbanna
VA Newport News Independent City	Boldrup Plantation Archeological Site, Newport News
VA Surry County	Pleasant Point

National Register Sites Related to Seventeenth Century Commerce

DE Sussex Co	DeVries Palisade, Lewes
	Pagan Creek Dike, Lewes
VA Hopewell Independent City	City Point Historic District, Hopewell
VA Middlesex County	Urbanna Historic District, Urbanna

Archeological Resources

The Chesapeake Bay

From the mysterious shipwreck lying off the tip of Tangier Island (possibly dating from the sixteenth century) to the Coast Guard cutter Cuyahoga that sank after slamming into a freighter in 1978, more than eighteen hundred different vessels have met their end in the Bay's waters.

Certain areas in the Bay are known for their treacherous shoals or exposure to dangerous storms. The area at the mouth of the Bay between Capes Henry and Charles is notorious for its shifting sand bars: it is so well known, in fact, that it has earned the name "the Middle Ground."

During wars, calamities of battle heightened the usual hazards of ship travel. Many of the shipwrecks in the Bay were casualties of the Revolutionary War, the War of 1812, and the Civil War. Direct hits from cannons, explosives and torpedoes brought down many of the ships, but fires and collisions also played a role.

By the latter part of the 1800s, steamboats became a popular means of traveling around the Bay. These boats were vulnerable to the whims of hurricanes or nor'easter storms, especially if caught in the open Bay with no cover. Marine archeologists use whatever records may be available, including old news reports, to help locate wrecks of possible historic interest.

Because the Chesapeake Bay is actually a drowned river valley, a significant portion of what is currently underwater was once dry land. Many prehistoric archaeological sites likely remain intact along the bottom of the Bay, and along ancient river terraces. Underwater archaeology has only recently begun to assess these hidden resources with new recovery techniques and predictive locational models. In fact, the absence of so many early sites would be accounted for by the fact that archaeologists have been looking in the wrong place.

The Chesapeake Plain

A wide variety of archeological resources, however, nevertheless remains on dry land, and most especially on the broad coastal plain surrounding the Bay. As these lands were most often occupied by sedentary agriculturists, and given the fact that these people tended to aggregate into larger settlements with more material remains, the Tidewater areas of the Chesapeake are likely a rich source of archaeological resources. Unfortunately, these resources are also in the closest proximity to modern populations and the forces of development, and they remain most at risk in the region.

Scientists estimate there are at least one hundred thousand archeological sites scattered around the Bay with only a small percentage documented. Most are susceptible to a variety of destructive factors, both natural and man-made, which imperil their existence. With development consuming land around the Bay at a rapid pace, undocumented sites may be bulldozed before their valuable information comes to light. When farmers plow their fields, they can inadvertently destroy artifacts from a Native American tribe long gone. As sea level rises, as it has for many thousands of years, shoreline erosion will continue to destroy many sites. Minimal till practices limit the likelihood of artifact dislocation, while shoreline stabilization projects help protect sites from wave erosion.

Ethnographic Resources

Ethnographic resources are natural and cultural resources that are important in the cultural practices, values, beliefs, heritage and identity of traditionally associated peoples and groups. Such groups may be ethnic and occupational groups, American Indian tribes, and other groups whose traditional cultural practices, values and beliefs connect them with the resources in Chesapeake Bay. These peoples must have been associated with the resource for at least two generations, or forty years,

prior to the establishment of the trail. Types of ethnographic resources include objects (such as in museum collections), structures (historic buildings, boats, etc.), sites (such as archaeological sites and burial locations), landscape features, and the cultural landscapes within which they are situated. Ethnographic resources may be identifiable from extant features (i.e., gravesites), but they usually require extensive consultation and localized research efforts to locate and document these properties.

Three main categories of ethnographic resources can be recognized in the Chesapeake Bay region: sites, landscapes, and ethnographically-important natural resources. Each of these types of resources relates to different traditionally associated groups such as Native Americans, ethnic enclaves, or traditional watermen, and at different times (e.g., mythical, prehistoric, historic), but they remain important aspects of our shared cultural heritage.

Sites are usually single locations of specific importance to an identifiable group of people. Included in this category would be sacred sites, such as traditional burial grounds, Indian spiritual locations, or 'lookout points.' Many of these types of ethnographic resources are identifiable from extant features (i.e., graves), but some may require extensive consultation and local research to locate and record these properties.

Ethnographic landscapes include widespread areas for resource acquisition and/or transport, rock quarrying, or traditional hunting or fishing territories, as well as corridors such as Indian trails, or routes and used by escaping slaves along the Underground Railroad. In many cases, these resources may be claimed and interpreted differently by different and competing groups of people. As cultural resources, however, they remain integral to the Bay's history.

Natural ethnographic resources include primarily seasonally-available anadromous fish,

deer, or ripening fruits and flowering plants. While arguably the most difficult to identify and protect, to many Native Americans, these resources are integral to defining their traditional existence.

SOCIOECONOMIC ENVIRONMENT

Land Use and Population

Land uses throughout the Chesapeake Bay area vary from highly agrarian to highly developed, particularly in the metropolitan areas of Washington DC, Baltimore, and Hampton Roads. According to the Multi-Resolution Land Characteristic Consortium, only 9.3% of the land area in the Chesapeake Bay watershed is intensely developed, with 15.2% and 75.5% with commercial development or low intensity development respectively. Land cover across the large watershed area has the following breakdown: 3.6% developed, 28.5% agriculture, 60.1% forested; 4.3% water, 2.6% wetland, and 0.9% barren. Approximately sixteen million people live in the Chesapeake Bay watershed; about ten million people live along its shores or near them.

The Chesapeake Bay Watershed is divided into eight smaller watersheds. These include the Susquehanna, Patuxent River, the Eastern Shore, the Rappahannock, Maryland Western Shore, James, York, and Potomac Rivers. The upper section of the Bay includes the Susquehanna and Maryland Western Shore Watersheds. The areas in these watersheds located along the Chesapeake Bay are industrial and commercial, such as the cities of Annapolis, Baltimore, and Havre de Grace, Maryland. However, the southern portion of the Maryland Western Shore Watershed consists of forestland. Directly along the Bay, these areas have a well-developed infrastructure of roads and are heavily populated. This area showed an increase in population from 1990 to 2000, and projections anticipate a continual increase in population through the year 2020.

The middle section of the Bay consists of the Eastern Shore, Patuxent River, and Potomac River Watersheds. The areas located along the Chesapeake Bay within these watersheds consist mainly of forest and agricultural land. Still, areas highly developed with residential and commercial uses exist sporadically along the Chesapeake Bay. These areas have a well developed infrastructure of roads. Populations, along the Bay, within these watersheds are denser than in other areas. An increase in population from 1990 to 2000 occurred and projections anticipate a continual increase in population through the year 2020. This is seen especially in Prince George's, Anne Arundel, and Montgomery Counties, Maryland.

The lower section of the Chesapeake Bay includes the York, Rappahannock, and the James Watersheds. The area in these watersheds is mostly agricultural and forested, with a little residential and commercial development interspersed. Populations in these areas are lower than in other areas of the Bay. There was an increase in population from 1990 to 2000, and it is anticipated that there will be a continual increase in population through the year 2020. The area along the Bay is not anticipated to have a well-developed infrastructure of roads. The exception is seen in and around Norfolk, where there is a large concentration of development, population, and infrastructure.

Economy

The economic mainstays of the Chesapeake Bay region since the late 1800s have been ports with their import and export, the seafood industry, agriculture, tourism, the military, and shipbuilding and repair. Major ports in the Chesapeake Bay include the City of Baltimore and the City of Norfolk, transporting container cargo and products such as coal, grain, tobacco, cocoa beans, and rubber.

The seafood industry remains a major factor in the economic life of the Chesapeake Bay. More than five hundred million pounds of seafood are harvested from the Bay every year. The

Chesapeake Bay is the largest producer of crabs in the United States. More than one third of the blue crab harvest in the United States comes from the Bay. The long-term outlook for the seafood industry is in question, however, as over-fishing and pollution of the Bay and rivers have caused a decrease in marine life populations and a destruction of habitat. Oyster populations have declined dramatically. Harvest is about one percent of what it was at the end of the nineteenth century, due to over-harvesting, pollution and disease.

Agriculture plays an important part in the Chesapeake Bay Watershed. For example, in Virginia, statistics show that, over the past forty years, farm production has increased 63%, while agricultural land use decreased 47% and labor decreased by 89%. Production of broiler chickens is the state's leading agricultural commodity, followed by milk, cattle, turkeys, tobacco, greenhouse and nursery plants, soybeans, eggs, winter wheat, and corn. Cotton is making a comeback with the new demand for natural fibers, and, in 1996, a new record was set for cotton production at 160 thousand bales.

Tourism continues to play a key role in the economy of the Chesapeake Bay region. Visitors come to the area from all over the United States and other countries. Attracted by the water, beaches and shores of the Bay, these visitors can also take in the historic sites and museums in the region. Maryland tourism reports show that visitors to the state in 2001 spent almost \$7.7 billion on goods and services, generated \$646 million in tax revenue, and indirectly provided more than 103,000 jobs. In Virginia, 275 historic attractions host more than 6.5 million visitors annually, with another 25 million annual visits to NPS areas.

The Chesapeake Bay economy is greatly influenced by a large military presence. A number of military bases border the bay or its tributaries. For example, at the mouth of the Bay, the Norfolk Naval Base contributes significantly to the economy in the tidewater area. Other bases

on the Chesapeake Bay contribute to the local economies. They include but are not limited to Aberdeen Proving Grounds on the northern end of the Bay and Langley Airforce Base near the southern end. Nearly a third of the region's workers earn a paycheck from the Department of Defense or a defense contractor. Norfolk has the world's largest Navy base, and Portsmouth is home to the world's biggest ship-repair yard.

Transportation

Two bridges cross the Chesapeake Bay: the Chesapeake Bay Bridge-Tunnel and the William Preston Lane Jr. Memorial Bridge (commonly referred to as the Chesapeake Bay Bridge). The Chesapeake Bay Bridge-Tunnel crosses the mouth of the Chesapeake Bay and connects the City of Virginia Beach to Cape Charles in North Hampton County on the Virginia Eastern Shore. It is 17.6 miles long from shore to shore, crossing what is essentially an ocean strait. Including land approach highways, the overall facility is twenty-three miles long, and it carries highway traffic on US-13, the major arterial highway serving the corridor between Norfolk, Virginia, and Wilmington, Delaware.

The Chesapeake Bay Bridge, officially the William Preston Lane, Jr., Memorial Bridge, crosses the Chesapeake Bay near Annapolis as part of US-50 / US-301. The bridge's dual spans connect Maryland's Eastern Shore recreational and ocean regions to the metropolitan areas of Baltimore, Annapolis, and Washington, D.C. The bridge also forms part of an alternative route from the Delaware Memorial Bridge to the nation's capital. The 4.3-mile Bay Bridge is a prominent and important element of the State of Maryland's transportation infrastructure. Carrying more than twenty-three million vehicles a year, the bridge consists of two separate spans with roadways running 186 feet above the water.

The Bay's ports and waterways are critical to the world's commerce. Approximately ninety

million tons of imports and exports pass through the major ports of Baltimore and Hampton Roads each year.

Parks and Recreation

In proximity to the proposed Captain John Smith Chesapeake National Historic Trail, there are seven NPS sites, twelve National Wildlife Refuges, and three National Natural Landmarks. The Chesapeake Bay Gateways Network (CBGN), a partnership system of sites, land trails, and water trails, around the Chesapeake Bay watershed, represents a broad cross-section of Bay-related resources. The Gateways Network includes 154 exceptional parks, wildlife refuges, museums, sailing ships, historic communities, and trails. Most of these sites are close to the Bay coastline or one of the tributary rivers. Chesapeake Bay Gateways are the places to experience, first-hand, Chesapeake Bay life and culture. Each communicates important facets of the Chesapeake story.

In addition to the CBGN, there are many state and local parks and over five hundred public access sites which are catalogued through the *Public Access Guide—Chesapeake Bay, Susquehanna River, & Tidal tributaries*.

The Chesapeake Bay and its rivers are a haven for fishing and for both motorized and non-motorized boating. Numerous marinas are located throughout the waterways to provide the boater with service. Local charter captains offer their expertise to the novice and professional fishermen. Handicapped assistance is available on many of the boats, if needed. Public fishing piers, scenic cruises and restaurant boats are also popular ways to enjoy the Bay. Tidal ponds, rivers, and saltwater marshes attract many canoers and kayakers. State parks and private campgrounds and outfitters offer canoe and kayak rentals. Private guides are available to assist paddlers in exploring pristine nooks and bays to view the birds and wildlife. The Bay's waters are also heavily used for sailing and rowing.

Figure 3: U.S Department of Interior Sites

NPS Sites	<p>Colonial National Historical Park—Jamestown</p> <p>Piscataway Park</p> <p>Fort Washington Park</p> <p>Anacostia Park</p> <p>Chesapeake & Ohio Canal NHP</p> <p>George Washington Memorial Parkway</p> <p>Potomac Heritage National Scenic Trail</p>
National Natural Landmarks	<p>Battle Creek Cypress Swamp, Calvert County, Maryland. Located on the east side of the Patuxent River, between Bowens and Port Republic.</p> <p>Long Green Creek and Sweathouse Branch, Baltimore County, Maryland. Located 2 miles north of Perry Hall.</p> <p>Belt Woods, Prince Georges County, Maryland A fifty-six acre site that is fifteen miles east of Washington, D.C. in the vicinity of Upper Marlboro.</p> <p>Caledon Natural Area, King George County, Virginia A 2,860 acre forest bordered on the north by the Potomac River.</p> <p>Great Dismal Swamp, Nansemond County and City of Chesapeake, Virginia. 43,200 acres, including Lake Drummond.</p> <p>Virginia Coastal Reserve, Accomack and Northampton Counties, Virginia. Occupying about forty-five miles of coast line, from ten miles south of Assateague Island to the mouth of the Chesapeake Bay.</p>
National Wildlife Refuges	<p>Eastern Shore of Virginia</p> <p>Featherstone, Virginia (currently closed to public)</p> <p>James River—Presquile, Virginia</p> <p>Mason Neck, Virginia</p> <p>Nansemond, Virginia (closed to public)</p> <p>Plum Tree Island, Virginia</p> <p>Rappahannock River Valley, Virginia</p> <p>Occoquan Bay, Virginia</p> <p>Chesapeake Marsh NWR Complex, Maryland: Blackwater, Martin, Susquehanna and Eastern Neck</p>

Maps 3 through 7 show all parks and public lands adjacent to the water and close to the trail routes. Map 9 shows all CBGN sites. Map 11 shows the sites which provide public boat ramps along the trail routes.

Tourism and Visitor Experience

The study area is a destination for local, regional, and out-of-state visitors. While tourism and visitor use statistics are often misleading due to double counting and the undifferentiated economic impacts of local visitors versus those from out-of town, it is important to understand the magnitude of visitation throughout the area and at specific sites. Statewide tourism statistics are not available due to the difficulty in gathering such data. The District of Columbia, Virginia, and Pennsylvania rank in the top five states for national park unit visitation.

The Chesapeake Bay region has many historic and cultural resources that attract local, regional and national visitors. The visitation rates at several different types and sizes of resources within the Chesapeake Bay Gateways Network serve as a proxy for the tourist activity at state parks, museums, and historic sites. The annual visitation rates, as illustrated in Figure 4, vary widely.

NATURAL RESOURCES

Surface Water Resources

The proposed trail would lie almost entirely on the waters of the Chesapeake Bay and portions

of eight of its largest tributaries: the James, York, Rappahannock, Potomac, Patuxent, Patapsco, Susquehanna, and Nanticoke Rivers. The major rivers link the study area's cultural and historic resources and provide a variety of recreational opportunities. The resources and connections created by the waterways opened up the area for settlement and trade and were a major factor in the location of development in the region.

The Chesapeake Bay is the nation's largest estuary (an area where fresh and salt water mix) and the world's third largest. The Bay's watershed of sixty-four thousand square miles encompasses parts of six states – New York, Pennsylvania, Maryland, Virginia, Delaware, West Virginia, plus the District of Columbia. The bay itself is approximately two hundred miles long, stretching from the mouth of the Susquehanna at Havre de Grace, Maryland, to Norfolk, Virginia. This provides about twenty-five hundred square miles of surface water. The Bay varies in width from about 3.4 miles near Aberdeen, Maryland, to 35 miles at its widest point, near the mouth of the Potomac River. The Bay is uniquely shallow, with an average depth of 21 feet. There are a few deep holes that are more than 170 feet deep. There are more than 11,600 miles of shoreline, including tidal wetlands and islands.

The Patuxent River Tributary drains about nine hundred square miles of land in portions of St. Mary's, Calvert, Charles, Anne Arundel, Prince George's, Howard, and Montgomery counties of Maryland. The Patuxent is the

Figure 4: Visits to Selected Chesapeake Bay Gateway Sites

Gateways Site	Location	Visits per year
Colonial NHP	Yorktown/Jamestown, VA	3.3 million
First Landing State Park	Norfolk, VA	1 million
Fort McHenry NMHS	Baltimore, MD	673,000
Gunpowder Falls State Park	Kingsville, MD	543,000
Blackwater NWR	Cambridge, MD	120,000
Chesapeake Bay Maritime Museum	St. Michaels, MD	95,000

largest river which drains entirely within Maryland. Large water bodies include the Western Branch, Little and Middle Patuxent Rivers, and two large water supply reservoirs on the mainstem river above Laurel, which supply water for the Washington metropolitan area. The watershed supports more than one hundred species of fish in its freshwater streams and brackish waters, including large-mouth bass, chain pickerel, catfish, weakfish and bluefish. The Patuxent also supports an important commercial and recreational blue crab fishery. The Patapsco/Back Rivers Basin drains about 630 square miles of land including all of Baltimore City and portions of Anne Arundel, Baltimore, Carroll, and Howard Counties. Larger waterbodies include Back River, Gwynns and Jones Falls, the North and South Branches of the Patapsco River, Lake Roland, Piney Run Reservoir, Liberty Reservoir, and Baltimore Harbor. The basin supports over forty species of fish, including white and yellow perch, and large and small-mouth bass. The area also supports a commercially productive oyster bar just outside the river's mouth, in the mainstem of the Bay.

The Middle Potomac Tributary Basin drains about 610 square miles of land, including portions of Montgomery and Prince George's County. The mainstem river serves as a receiving tributary for upriver sources. Major tributaries include Seneca, Rock and Piscataway Creeks and the Anacostia River. The basin supports over one hundred species of fish in its freshwater streams and brackish waters, including white and yellow perch, largemouth bass, and catfish. Bladensburg was once a colonial port on the Anacostia River, but due to centuries of sedimentation, is no longer navigable except to small recreational watercraft.

The Lower Potomac River basin drains approximately 730 square miles of Charles, St. Mary's, and Prince George's counties. Within the Lower Potomac basin are eleven smaller watersheds, including the Mattawoman River, Wicomico River, Breton Bay, and St.

Mary's River. More than one hundred species of fish are supported in the basin's freshwater streams and brackish waters, including American and hickory shad, menhaden, and gizzard shad. The basin also supports one of the largest great blue heron rookeries on the East Coast.

The James River, Virginia's largest river, is about 335 miles long. Its drainage, covering some ten thousand square miles, lies wholly within Virginia and includes some or all of thirty-nine counties. Since its headwaters lie far up in the Appalachian Mountains, it brings great quantities of fresh water down to the Chesapeake Bay. In the process, the river passes through a gap it has made in the Blue Ridge, after which it follows a broad and fertile valley where a mixture of forests and more open grasslands, and later agricultural fields, have fostered grazing wildlife. The lands along the mouth of the James are low, with dune-fields and sandy peninsulas along the southern and western rim of the Bay itself. The James is densely lined with marshes from the Hampton Roads area up to about Hatcher Island.

The York River lies across the Virginia Peninsula from the James and passes through similar terrain from the western margin of the Chesapeake Bay to the Piedmont. It divides at West Point, Virginia, into two major branches, the Pamunkey and the Mattaponi. The York drains about 2,670 square miles (about twelve percent of Virginia's part of the Chesapeake's drainage). As with other tributaries of the Chesapeake, the York River's flow changes significantly with the seasons: highest in March and April, when it carries snowmelt, and lowest in October to November. The York is bounded by low, flat land that grades into marshlands near the Bay. Many fish species enter the lower York as part of their life cycle, including striped bass, sea trout, drum, spot, croaker and flounder.

The Nanticoke River is one of the largest tributaries of the Chesapeake on the Eastern

Shore. It has extensive marsh and hammocks to the wets of its mouth and uplands on the east side. This river, which has its headwaters in Delaware, drains 718,000 acres of wetlands, a third of Delaware's land, taking its waters from the swamps and cultivated flatlands of Sussex County and flowing into Maryland, where it empties into Tangier Sound and the Chesapeake Bay. The Nanticoke is endowed with abundance and diversity of wildlife, undisturbed land, and rural characteristics. The river and its major tributaries—Broad Creek, Deep Creek, Gravelly Branch, and Marshyhope Creek - are free of dams and support excellent fisheries. Bald eagles, ospreys, and great blue herons are common in the skies above the Nanticoke, while the waters below support many fish and shellfish, including American shad, striped bass, large-mouth bass, white and yellow perch, crabs, oysters, and clams. Flocks of migrating waterfowl—black ducks, canvasbacks, mallards, and teal—use the Nanticoke as a resting point and wintering area. Otters, owls, and muskrats also call the Nanticoke their home.

The Susquehanna River flows 444 miles from its headwaters near Cooperstown, New York, to Havre de Grace, Maryland, where it meets the Chesapeake Bay. The river drains 27,500 square miles, covering half the land area of Pennsylvania and portions of New York and Maryland. It is the largest tributary of the Chesapeake Bay, providing ninety percent of the fresh water flows to the upper half of the bay and fifty percent overall. It comprises forty-three percent of the Chesapeake Bay's drainage area. The river carries an immense amount of rainwater out of its watershed, a billion gallons per day even during a drought year. The lower Susquehanna supports thirty-nine species of fish, including four species of game fish, as well as one species of mussel and sixteen species of reptiles and amphibians.

The Susquehanna River migratory fish restoration partnership, including Pennsylvania and Maryland, the electric utilities, fisheries agencies and the Susquehanna River Basin

Commission, has installed fish passages at the four hydroelectric dams on the lower Susquehanna. This has reopened the Susquehanna River to American shad and other migratory species. The Susquehanna River (to its headwaters) and its tributaries were once the historic range for these migratory fish species as they journeyed from the Atlantic Ocean through the Chesapeake Bay and upstream to the rivers of their origin.

The Susquehanna Flats make up a broad, shallow sediment trap adjacent to that river's mouth, where the confined, rapidly flowing Susquehanna spreads out into the Bay, slowing in velocity and depositing much of its sediment. The Flats have a maximum depth of ten feet in most places. Half a dozen species of freshwater rooted aquatic plants make up a thick bed of underwater grasses that extends from the northern tip of Spesutie Island to Furnace Bay, at the Chesapeake's head.

Estuarine Environment

The Bay itself is an estuary—a place where fresh river water mixes with the salty Atlantic Ocean currents. It is the largest estuary in the United States and one of the largest in the world. The Bay consists of deep and shallow open salt waters and brackish waters of the lower tidal portions of the rivers. The fresh waters of the rivers and streams flow into the Bay, making it ten percent less salty than the ocean. The Bay was formed at the end of the last Ice Age, when melting glaciers caused sea levels to rise worldwide. Its deepest portions trace what in ancient times was the path of the Susquehanna River; its shallower parts were formed when land was flooded by rising ocean waters. Deeper waters are home to many species of fish, shellfish, and, on occasion, visiting ocean fish and aquatic mammals.

The Coastal Plain that borders the Bay is comprised of beaches, marshes, forests, and grasslands. This coastal area, often referred to as the "Tidewater" since the waters along the shore rise and fall, tends to be flat and drained

by salty and brackish waters.

Where the broad shallows merge with the land's edge, the Chesapeake forms a quarter-million acres of tidal marshes, or wetlands. The Bay wetlands provide particularly crucial habitat for fish, shellfish, various waterfowl, shorebirds, wading birds, and several mammals. Striped bass, menhaden, flounder, oysters, and blue crabs are among the most commercially important fish and shellfish that depend on estuarine wetlands.

Fish and Other Aquatic Life

A tremendous diversity of aquatic life inhabits shallow water environments. The best-known animal in the Chesapeake Bay is the blue crab, but the Bay watershed provides food, water, cover and nesting or nursery areas to 3,600 species of plant and animal life, including more than 300 fish species and 2,700 plant types. Rich plant communities that grow in the shallow waters, such as submerged aquatic vegetation and tidal marshes, provide key habitats for many invertebrates, fish, and waterfowl in various life stages. Shrimp, killifish, and juveniles of larger fish species use submerged aquatic vegetation, tidal marshes, and shallow shoreline margins as nursery areas and for refuge. Vulnerable shedding blue crabs also find protection in submerged aquatic vegetation beds. Predators (including blue crabs, spot, striped bass, waterfowl, colonial water birds, and raptors) forage for food here. Along the shoreline, fallen trees and limbs also give cover to small aquatic animals. Even unvegetated areas, exposed at low tide, are productive feeding areas. Microscopic plants cycle nutrients and are fed upon by crabs and fish.

The fish in the Bay region fall into two categories: resident and migratory. Of the over three hundred species of fish known to inhabit the Chesapeake Bay region, thirty-two species are year-round residents of the Bay. Resident fish tend to be smaller than migratory species and often occur in shallow waters, where they feed on a variety of invertebrates.

The resident Bay anchovy, for example, is the most abundant fish in the Bay waters and consequently forms a critical link in the food web because it serves as the dietary basis for many other species, including some species of birds and mammals. In the winter, it remains in the deep waters of the Bay, but, in the warmer seasons, it clings to shoreline areas, swimming in schools and feeding on zooplankton. The Bay anchovy spawns at night from April through September in warm areas of the estuary, where the temperature is above 54° F.

Migratory fish fall into two categories: catadromous or anadromous. Catadromous fish live in fresh water, but travel to the high-salinity ocean waters to spawn. The only catadromous species in the Bay ecosystem is the American eel, or *Anguilla rostrata*, which leaves its habitat in the Bay to spawn in the Sargasso Sea. Anadromous fish (fish whose incubation and juvenile state is in fresh water, maturation state is at sea, and later as adult, migrate into rivers for reproduction) such as the American shad and the Blueback herring, travel from the high salinity waters of the lower Bay or Atlantic Ocean to spawn in the Bay watershed's freshwater rivers and streams. Other anadromous fish travel shorter distances to spawn and occupy a narrower range of salinities. For example, white perch journey from the middle Bay, which is not as salty as the ocean, to freshwater areas of the upper Bay and tributaries to spawn.

Federally Listed Threatened and Endangered Species

The Puritan tiger beetle (*Cicindela puritana*) can be found on narrow beaches backed by cliffs in several Maryland locations including Calvert county and near the mouth of the Sassafras River in Kent and Cecil Counties. The northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) occurs on wider, sandy beaches in Calvert and Somerset Counties in Maryland and on both shorelines of the Chesapeake Bay in Virginia. In the Chesapeake Bay region, these species are threatened by

habitat alterations associated with human population growth, shoreline development and shore erosion control.

Endangered: Shortnose sturgeon, *Acipenser brevirostrum*, found in Chesapeake Bay and tributaries

Endangered: Atlantic ridley turtle, *Lepidochelys kempi*, summer visitor to Chesapeake Bay

Other Wildlife

The region provides habitat for a wide variety of animals. Important mammals include the whitetail deer, black bear, bobcat, red fox, gray fox, gray squirrel, fox squirrel, eastern chipmunk, white-footed mouse, pine vole short-tail shrew, and cotton mouse. Common small mammals include raccoons, opossums, rabbits, and numerous species of ground-dwelling rodents. The turkey, ruffed grouse, bobwhite, and mourning dove are the principal game birds. Migratory non-game bird species are numerous, as are migratory waterfowl. Nearly thirty species of waterfowl visit the Bay during the winter. The most abundant breeding birds include the cardinal, tufted titmouse, wood thrush, summer tanager, red-eyed vireo, blue-gray gnatcatcher, and Carolina wren. Characteristic reptiles include the box turtle, common garter snake, and timber rattlesnake.

Vegetation

An important component of the Chesapeake Bay wetland ecosystem is submerged aquatic vegetation (SAV) – vascular plants that grow entirely under water. SAV provides habitat and food for fish, waterfowl, shellfish, and other invertebrates. Sixteen species of SAV are commonly found in the Chesapeake Bay or nearby rivers. Salinity is the primary factor affecting SAV distribution. Historically, 200,000 acres of Bay grasses grew along the shoreline; only 38,000 acres remained in 1984. The loss of SAV is due primarily to increased turbidity, which prevents light penetration to the plants, thus reducing photosynthesis; sedimentation that covers the plants; and increased nutrients in the water, which increases the algae popula-

tion and also reduces light penetration. The primary source of this loss is runoff from agriculture, new development, and industry. Because of restoration and conservation efforts in the Bay and the watershed, the area of SAV had increased to 85,000 acres by 2001.

OPERATIONS AND ADMINISTRATION

The public and private resources that contribute to the significance of the proposed trail are currently under a variety of management and ownership. While there are numerous publicly owned and/or publicly accessible lands and resources in the study area, no one entity coordinates the interpretation and protection of resources related to the John Smith voyages.

The study team has documented substantial technical, financial and organizational commitments to the designation and implementation of the proposed Captain John Smith Chesapeake National Historic Trail. Many local governments, tourism agencies, and the states have indicated an interest in having a strong connection to a Captain John Smith Chesapeake National Historic Trail, in a range of ways, from commemorative events and other tourism-related activities, to interpreting the stories and preserving the resources related to the trail. To date, no formal organization has been established related specifically to the trail.

In addition to financial and programmatic commitments, staffing, maintenance, security, provision of facilities, resource protection, and interpretation must be considered during the management planning efforts for the trail. Individual resource sites have maintenance, security, and resource protection measures in place. There is no overarching maintenance or coordinating organization.

Many interpretive sites along the proposed trail have existing visitor facilities that include restrooms, drinking fountains, seating, and parking areas.